

## CLAIMS

What is claimed is:

1. A code division multiple access user equipment, the user equipment receives K data signals over a shared spectrum, the user equipment comprising:

means for receiving and sampling a combined signal having the K transmitted data signals over the shared spectrum;

means for producing a combined channel response matrix using codes and impulse responses of the K data signals;

means for determining a block column of a cross correlation matrix using the combined channel response matrix, each block entry of the block column being a K by K matrix;

means for taking a fourier transform of a complex conjugate transpose of the combined channel response matrix multiplied to the combined signal samples;

means for multiplying an inverse of a fourier transform of each block entry to a result of the fourier transform to produce a fourier transform of the data vector; and

means for taking an inverse fourier transform of the data vector fourier transform to produce data of the K data signals.

2. The user equipment of claim 1 wherein the taking the fourier transform is by multiplying the conjugate transpose of the combined channel response matrix to the combined signal samples and taking fourier transform of a result of the conjugate transpose multiplication.

3. The user equipment of claim 1 wherein a Cholesky decomposition of the block entries of the diagonal matrix is used to determine the data.

4. The user equipment of claim 1 wherein the data determining occurs over a data field time period of a time division duplex communication burst and the combined signal samples extend beyond the data field time period.

5. The user equipment of claim 4 wherein extended samples of the combined signal samples extends beyond the data field time period for a length of the impulse response.

6. The user equipment of claim 4 wherein the combined signal samples extends beyond the data field time period so that a length of the combined signals is a length compatible with a prime factor algorithm fast fourier transform.

7. A code division multiple access user equipment, the user equipment receives K data signals over a shared spectrum, the user equipment comprising:

an antenna for receiving a combined signal having the K transmitted data signals over the shared spectrum;

a sampling device for sampling the combined signal;

a channel estimator for estimating impulse responses of the K data signals; and

a data detection device for producing a combined channel response matrix using codes and the impulse responses of the K data signals; for determining a block column of a cross correlation matrix using the combined channel response matrix, each block entry of the block column being a K by K matrix; for taking a fourier transform of a complex conjugate transpose of the combined channel response matrix multiplied to the combined signal samples; multiplying an inverse of a fourier transform of each block entry to a result of the fourier transform to produce a fourier transform of a data vector; and for taking an inverse fourier transform of the data vector fourier transform to produce data of the K data signals.

8. The user equipment of claim 7 wherein the taking the fourier transform is by multiplying the conjugate transpose of the combined channel response matrix to the combined signal samples and taking fourier transform of a result of the conjugate transpose multiplication.

9. The user equipment of claim 7 wherein a Cholesky decomposition of the block entries of the diagonal matrix is used to determine the data.

10. The user equipment of claim 7 wherein the data determining occurs over a data field time period of a time division duplex communication burst and the combined signal samples extend beyond the data field time period.

11. The user equipment of claim 10 wherein extended samples of the combined signal samples extends beyond the data field time period for a length of the impulse response.

12. The user equipment of claim 10 wherein the combined signal samples extends beyond the data field time period so that a length of the combined signals is a length compatible with a prime factor algorithm fast fourier transform.